

## PD4-C/CB CANopen



Short instructions Version 1.0.0  
Original: de

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## Introduction

The *PD4-C* is a brushless motor with integrated controller. The integrated absolute encoder makes immediate operation possible in *closed loop* mode without homing.

This document describes the installation and commissioning of the motor. You can find the detailed documentation for the product on the Nanotec website [us.nanotec.com](http://us.nanotec.com). The short instructions do not replace the technical manual of the product.

## Copyright, marking and contact

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## Intended use

The *PD4-C* motor with integrated controller is designed for use under the approved **Environmental conditions**.

Any other use is considered unintended use.



### Note

Changes or modifications to the product are not permitted.

## Warranty and disclaimer

Nanotec produces component parts that are used in a wide range of industrial applications. The selection and use of Nanotec products is the responsibility of the system engineer and end user. Nanotec accepts no responsibility for the integration of the products in the end system.

Under no circumstances may a Nanotec product be integrated as a safety controller in a product or construction. All products containing a component part manufactured by Nanotec must, upon delivery to the end user, be provided with corresponding warning notices and instructions for safe use and safe operation. All warning notices provided by Nanotec must be passed on directly to the end user.

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## Specialist staff

Only specialists may install, program and commission the device:

- Persons who have appropriate training and experience in work with motors and their control.
- Persons who are familiar with and understand the content of this technical manual.
- Persons who know the applicable regulations.

## EU directives for product safety

The following EU directives were observed:

- RoHS directive (2011/65/EU, 2015/863/EU)
- EMC directive (2014/30/EU)

## Other applicable regulations

In addition to this technical manual, the following regulations are to be observed:

- Accident-prevention regulations
- Local regulations on occupational safety

## Safety and warning notices

### Note



- Damage to the controller.
- Changing the wiring during operation may damage the controller.
- Only change the wiring in a de-energized state. After switching off, wait until the capacitors have discharged.

### Note



- Fault of the controller due to excitation voltage of the motor.
- Voltage peaks during operation may damage the controller.
- Install suitable circuits (e.g., charging capacitor) that reduce voltage peaks.

### Note



- There is no polarity reversal protection.
- Polarity reversal results in a short-circuit between supply voltage and GND (earth) via the power diode.
- Install a line protection device (fuse) in the supply line.

### Note



- The device contains components that are sensitive to electrostatic discharge.
- Improper handling can damage the device.
- Observe the basic principles of ESD protection when handling the device.

## Technical details and pin assignment

## Environmental conditions

Environmental condition	Value
Protection class	IP20
Ambient temperature (operation)	-10 ... +40°C
Air humidity (non-condensing)	0 ... 85%
Altitude of site above sea level (without drop in performance)	1500 m
Ambient temperature (storage)	-25 ... +85°C

## Electrical properties and technical data

### Technical data – motor

	PD4-C	PD4-CB
Type	High-pole DC servo (stepper motor)	Low-pole DC servo (BLDC)
Operating voltage	12 V to 48 V DC +/-5%	12 V to 24 V DC +/-5%
Rated current	4.2 A rms	8 A rms
Peak current for 1 s	Max. 6.3 A rms	Max. 20 A rms

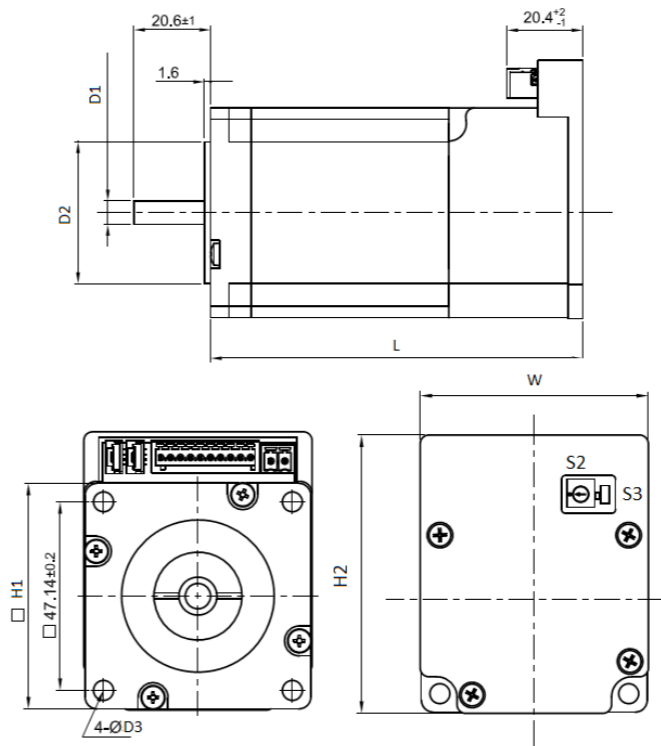
### Technical data

Property	Description / value
Operating modes	<i>Profile Position Mode, Profile Velocity Mode, Profile Torque Mode, Velocity Mode, Homing Mode, Interpolated Position Mode, Cyclic Sync Position Mode, Cyclic Sync Velocity Mode, Cyclic Synchronous Torque Mode, Clock-Direction Mode</i>
Set value setting / programming	<i>CANopen, Clock-direction, analog, NanoJ program</i>
Inputs	4 digital inputs (+5 V/+24 V), individually switchable by means of software, factory settings: 5 V 1 analog input, 10-bit resolution, 0-10 V
Outputs	2 outputs, (open drain, 0 switching, max. 24 V and 100 mA)
Integrated encoder	Magnetic, single-turn absolute encoder, 1024 pulses/revolution

Property	Description / value
Protection circuit	Overvoltage and undervoltage protection Overtemperature protection (> 75° Celsius on the power board) Polarity reversal protection: In the event of a polarity reversal, a short-circuit will occur between supply voltage and GND over a power diode; a line protection device (fuse) is therefore necessary in the supply line. The values of the fuse are dependent on the application and must be dimensioned <ul style="list-style-type: none"> <li>greater than the maximum current consumption of the controller</li> <li>less than the maximum current of the voltage supply.</li> </ul> If the fuse value is very close to the maximum current consumption of the controller, a medium / slow tripping characteristics should be used.

## Dimensioned drawings

All dimensions are in millimeters.



Dimension	Value
L	<ul style="list-style-type: none"> <li>PD4-C5918X4204-E: 65±1</li> <li>PD4-C5918M4204-E: 79±1</li> <li>PD4-C5918L4204-E: 100±1</li> <li>PD4-C6018L4204-E: 112.5±1</li> <li>PD4-CB59M024035-E: 94.9±1</li> </ul>
W	<ul style="list-style-type: none"> <li>PD4-C5918X4204-E: 57</li> <li>PD4-C5918M4204-E: 57</li> <li>PD4-C5918L4204-E: 57</li> <li>PD4-C6018L4204-E: 60.5</li> <li>PD4-CB59M024035-E: 57</li> </ul>
H1	<ul style="list-style-type: none"> <li>PD4-C5918X4204-E: 56.4</li> <li>PD4-C5918M4204-E: 56.4</li> <li>PD4-C5918L4204-E: 56.4</li> <li>PD4-C6018L4204-E: 60±0.5</li> <li>PD4-CB59M024035-E: 56.6±0.5</li> </ul>

Dimension	Value
H2	<ul style="list-style-type: none"> <li>PD4-C5918X4204-E: 69.6</li> <li>PD4-C5918M4204-E: 69.6</li> <li>PD4-C5918L4204-E: 69.6</li> <li>PD4-C6018L4204-E: 71.3</li> <li>PD4-CB59M024035-E: 69.6</li> </ul>
D1	<ul style="list-style-type: none"> <li>PD4-C5918X4204-E: 6.35<sup>+0</sup><sub>-0.013</sub></li> <li>PD4-C5918M4204-E: 6.35<sup>+0</sup><sub>-0.013</sub></li> <li>PD4-C5918L4204-E: 6.35<sup>+0</sup><sub>-0.013</sub></li> <li>PD4-C6018L4204-E: 8<sup>+0</sup><sub>-0.015</sub></li> <li>PD4-CB59M024035-E: 8<sup>+0</sup><sub>-0.013</sub></li> </ul>
D2	<ul style="list-style-type: none"> <li>PD4-C5918X4204-E: 38.1±0.025</li> <li>PD4-C5918M4204-E: 38.1±0.025</li> <li>PD4-C5918L4204-E: 38.1±0.025</li> <li>PD4-C6018L4204-E: 38.1±0.05</li> <li>PD4-CB59M024035-E: 38.1<sup>+0</sup><sub>-0.005</sub></li> </ul>
D3	<ul style="list-style-type: none"> <li>PD4-C5918X4204-E: 5</li> <li>PD4-C5918M4204-E: 5</li> <li>PD4-C5918L4204-E: 5</li> <li>PD4-C6018L4204-E: 4.5</li> <li>PD4-CB59M024035-E: 5.2±0.25</li> </ul>

## Overtemperature protection

Above a temperature of approx. 75°C on the power board (corresponds to 65–72°C outside on the back cover), the power part of the controller switches off and the error bit is set. After cooling down and confirming the error, the controller again functions normally.

## LED signaling

### Power LED

### Normal operation

In normal operation, the green power LED flashes briefly once per second.

### Case of an error

If an error has occurred, the LED signals an error number..

The following table shows the meaning of the error numbers.

Flash rate	Error
1	General
2	Voltage
3	Temperature
4	Overcurrent
5	Controller
6	Watchdog-Reset

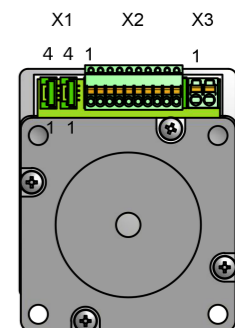



### Note

For each error that occurs, a more precise error code is stored in object **1003<sub>h</sub>**.

## Pin assignment

Pin 1 is marked.



Connector	Function	Pin assignment / description															
X1	CANopen IN/OUT and external logic supply  The contacts of both connector are connected to each other.	<ol style="list-style-type: none"> <li>+UB Logik (24 V DC/approx. 32 mA, external logic supply for the communication)</li> <li>CAN+</li> <li>CAN-</li> <li>GND</li> </ol>															
X2	Digital and analog inputs and outputs  Switching thresholds for digital <b>inputs 1 - 4</b> : <b>5 V (factory setting)</b> : On: >3 V; Off: <1 V <b>24 V</b> : On: >16 V; Off: <8 V	<ol style="list-style-type: none"> <li>GND</li> <li>Analog input: 10 Bit, 0-10 V</li> <li>12V output: +12 VDC, max. 100 mA</li> <li>Digital output 1: Open drain, max 24 V/100 mA</li> <li>Digital output 2: Open drain, max 24 V/100 mA</li> <li>Digital input 1; 5 V / 24 V Signal, switchable with object <b>3240<sub>h</sub></b></li> <li>Digital input 2; 5 V / 24 V Signal, switchable with object <b>3240<sub>h</sub></b></li> <li>Digital input 3; 5 V / 24 V, switchable with object <b>3240<sub>h</sub></b>, max. 1 MHz; <i>direction input</i> in clock/direction mode</li> <li>Digital input 4; 5 V / 24 V, switchable with object <b>3240<sub>h</sub></b>, max. 1 MHz; <i>clock input</i> in clock/direction mode</li> <li>GND</li> </ol>															
X3	Voltage supply PD4-C: 12-48 V DC ±5% PD4-CB: 12-24 V DC±5%	<ol style="list-style-type: none"> <li>+UB</li> <li>GND</li> </ol>															
S2	Hex coding switch for setting the <i>Node-ID</i> and baud rate. 	<table border="1"> <thead> <tr> <th>Value of the switch</th> <th>Node-ID</th> <th>Baud rate</th> </tr> </thead> <tbody> <tr> <td>0<sub>h</sub></td> <td>Objekt <b>2009<sub>h</sub></b></td> <td>1MBd</td> </tr> <tr> <td>1-7<sub>h</sub></td> <td>Value of the switch</td> <td>1MBd</td> </tr> <tr> <td>8<sub>h</sub></td> <td>Object <b>2009<sub>h</sub></b></td> <td>Object <b>2005<sub>h</sub></b></td> </tr> <tr> <td>9<sub>h</sub>-F<sub>h</sub></td> <td>(Number of the switch)-8</td> <td>Object <b>2005<sub>h</sub></b></td> </tr> </tbody> </table>	Value of the switch	Node-ID	Baud rate	0 <sub>h</sub>	Objekt <b>2009<sub>h</sub></b>	1MBd	1-7 <sub>h</sub>	Value of the switch	1MBd	8 <sub>h</sub>	Object <b>2009<sub>h</sub></b>	Object <b>2005<sub>h</sub></b>	9 <sub>h</sub> -F <sub>h</sub>	(Number of the switch)-8	Object <b>2005<sub>h</sub></b>
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S3	DIP switch for 120 Ω termination for CAN-Bus.	<b>OFF</b> : The CAN bus termination is off. <b>ON (up)</b> : The CAN bus termination is on.															

#### Note

- EMC: For a DC power supply line longer than 30 m or when using the motor on a DC bus, additional interference-suppression and protection measures are necessary.
- An EMI filter is to be inserted in the DC supply line as close as possible to the controller/motor.
- Long data or supply lines are to be routed through ferrites.

## Commissioning

The *Plug & Drive Studio* software offers you an option for performing the configuration and adapting the motor parameters to your application. You can find further information in document *Plug & Drive Studio: Quick Start Guide* at [us.nanotec.com](http://us.nanotec.com).

Observe the following notes:

#### CAUTION

- Moving parts can cause hand injuries.
- If you touch moving parts during running operation, hand injuries may result.
- Do not reach for moving parts during operation. After switching off, wait until all movements have ended.

#### CAUTION

- In free-standing operation, motor movements are uncontrolled and can cause injuries.
- If the motor is unsecured, it can, e.g., fall down. Foot injuries or damage to the motor could occur.
- If you operate the motor free-standing, observe the motor, switch it off immediately in the event of danger and make certain that the motor cannot fall down.

#### CAUTION

- Moving parts can catch hair and loose clothing.
- During running operation, moving parts can catch hair or loose clothing, which may lead to injuries.
- If you have long hair, wear a hairnet or take other suitable protective measures when near moving parts. Do not work with loose clothing or ties near moving parts.

#### CAUTION

- Risk of overheating or fire if there is insufficient cooling.
- If cooling is insufficient or if the ambient temperature is too high, there is a risk of overheating or fire.
- During use, make certain that the cooling and ambient temperature conditions are ensured.

#### Note

- EMC: Current-carrying cables – particularly around supply and motor cables – produce electromagnetic alternating fields.
- These can interfere with the motor and other devices. Nanotec recommends the following measures:
  - Use shielded cables and earth the cable shielding on both ends over a short distance.
  - Use cables with cores in twisted pairs.
  - Keep power supply and motor cables as short as possible.
  - Earth motor housing with large contact area over a short distance.
  - Lay supply, motor and control cables physically separate from one another.

### Establishing communication via CANopen

- Connect the CANopen master to the controller via the CAN- and CAN+ cables. Check the connection of your CAN-GND and that the necessary **120 ohm termination resistor** is present between CAN+ and CAN-.
- Supply the controller with voltage.

#### Note

- If you would like to use the logic supply instead of the main supply, you must set bit 0 in **4013<sub>h</sub>:01<sub>h</sub>** and save this object (set 1010<sub>h</sub>:03<sub>h</sub> to "65766173<sub>h</sub>").

- Change the configuration values if necessary.

The controller is set per default to node-ID 1, baud rate 1 Mbaud.

- To test the interface, send bytes 40 41 60 00 00 00 00 00 to the controller.  
Statusword (6041<sub>h</sub>) was read; you receive this response: 4B 41 60 00 XX XX 00 00.

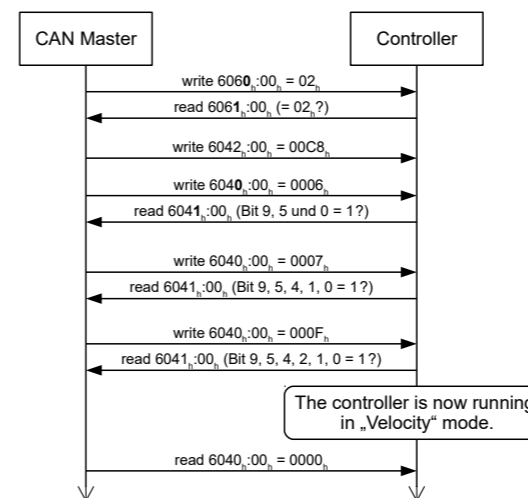
### Test run

As an example, the **Velocity** operating mode is used.

The values are transferred from your *CANopen master* or to the controller. After every transfer, the *master* should use the status objects of the controller to ensure successful parameterization.

- Select the *Velocity* mode by setting object **6060<sub>h</sub>** (Modes Of Operation) to the value "2".
- Write the desired speed in **6042<sub>h</sub>**.
- Switch the *power state machine* to the *Operation enabled* state.

The following sequence starts *Velocity* mode; the motor turns at 200 rpm.



- To stop the motor, set controlword (**6040<sub>h</sub>**) to "0".